PACE MISSION APPLICATIONS – Ecological Forecasting: Harmful Algal Blooms

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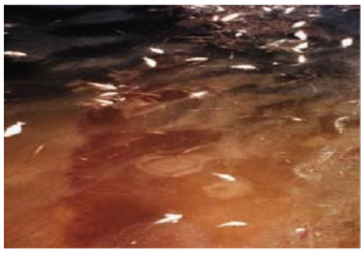

Upper Left: Harmful Algal Blooms kill fish, contaminate seafood and pollute our waters (Photo from NOAA/IOOS). Lower Left: Warning sign for cyanobacteria (Image Credit: J. Graham, USGS). Right: Satellite image of Lake Erie, showing the extent of the 2011 harmful algal bloom (the most severe in decades). Credit: MERIS/NASA; processed by NOAA/NOS/NCCOS.

Application Question/Issue

How can we better understand the causes and impacts (economic, cultural, environmental, human health) of Harmful Algal Blooms (HABs), and how can we improve routine monitoring and ecological forecasting of HABs using ocean observations from space?

Who Cares and Why?

Coastal HAB events have been estimated to result in economic impacts in the United States of at least $82 million each year. The impacts of HABs range from environmental (e.g., alteration of marine habitats and impacts on marine organisms including endangered species), to human health (e.g., illness or even death through shellfish consumption, asthma attacks through inhalation of airborne HAB toxins), to socio-economic and cultural (e.g., commercial fisheries, tourism, recreation).

NOAA, USGS, EPA (e.g., Cyanobacteria Assessment Network (CyAN); Gulf of Mexico Program), and other state and local agencies, increasingly require improved water quality observations to monitor and understand HAB events. To protect human health and the environment, it is imperative to provide communities with predictive warnings, so they can adequately plan and respond to the adverse effects associated with HABs.

Needed Measurements

Routine monitoring and improved forecasting of HABs often require satellite observations of sea surface temperature, chlorophyll-a, and HAB specific pigments. To meet the needs of the inland and coastal communities, satellite measurements must be produced at high spatial resolutions, with a spatial coverage that includes coastal waters (<100 nautical miles from the coast), signal-to-noise ratio (SNR) of 1000, uncertainty of 30%, and range of 0.5-400 ug/L. Extended spectral coverage in the near infrared and shortwave infrared regions would be particularly helpful for species differentiation.

The NASA Response

The high (5-nm) spectral resolution of PACE Ocean color instrument (OCI) will allow algorithms to be developed for identifying and quantifying specific phytoplankton groups, thus allowing identification of HABs and tracking their evolution and variability over seasonal to interannual time scales. This information will lead to drastically improved understanding of environmental factors governing HAB occurrence and demise. The PACE ocean color data latency (within 24hr), extended spectral range from the ultraviolet (345nm) to short-wave infrared (SWIR; 2260nm), spatial coverage (global), and spatial resolution of 1 km at nadir in inland, estuarine, coastal and shelf waters, will meet many community needs for improved space-based HAB detection. Combining advanced modeling methodologies with high-quality PACE ocean color imagery and ancillary observations from various platforms, including other space, aircraft, and *in situ* sensors, will allow us to vastly improve ecological forecasting of the location and extent of HABs.

Comments? Thoughts?

For additional information about PACE Applications or this particular application, please contact the PACE Applications Team at:
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